THE

JOURNAL OF GEOLOGY

JULY-AUGUST, 1899

A NEW ANALCITE ROCK FROM LAKE SUPERIOR

Among other regions on the northern shores of Lake Superior examined last summer by the writer for the Ontario Bureau of Mines the vicinity of Heron Bay, where the Canadian Pacific Railway first touches the lake when coming from the east, proved very interesting, a thick series of schist conglomerates with pebbles and bowlders mainly of felsite and quartz-porphyry occurring there, mapped by Dr. Bell of the Canadian Geological Survey as Huronian. Along the rocky shore of the bay, and also in cuttings on the railway west of the station, good exposures of these rocks are seen, sometimes so rolled out that the forms of the pebbles are almost, or completely, lost. Crossing the schist conglomerates are numerous dikes, which unfortunately were not carefully studied owing to lack of time, though hand specimens of the more typical dike rocks were taken. In the field the dikes were considered to consist of diabase, diabase-porphyrite, and felsite, all common rocks in the western Keewatin.

Microscopical study of the specimens obtained showed that the diabase and porphyrite present no unusual features, and that one of the felsitic-looking rocks is quartzless porphyry of a kind common in western Ontario. Another rock taken for felsite, dark red and slightly spotted with green, turns out, however, to

be of a new type, and will be described here because of its interesting mineralogical and chemical composition.

The specimens were obtained near mile 804 in a cutting on the railway, one being chosen to represent the freshest material seen, another weathered, and presenting a mottling of red and dark green, almost suggesting a variety of amygdaloid. Sections of the latter specimen are so completely weathered that little of its original composition can be determined; but sections of the fresh specimen show that the greenish spots consist almost wholly of feldspars having a confused radiating arrangement giving spherical forms; while the red part is composed of an isotropic base like a clear glass penetrated by radiating bundles of green prisms and also larger bundles of feldspar laths, brown with particles of iron oxide. A little calcite scattered through the section proves that the rock is no longer fresh.

The vague spheres of feldspar often have an imperfect black cross in polarized light, and consist mainly of orthoclase, somewhat turbid and specked with brown iron oxide, with a little of the green mineral intermixed. The rest of the rock contains some orthoclase also, but consists chiefly of the isotropic substance inclosing the radiating bundles of prisms referred to before. The green prisms are fresh in color and appearance, and are usually distinctly dichroic, dark green when the prism is parallel to the chief section of the nicol, yellowish-green at right angles to this position. Extinction is nearly parallel, but angles of $4\frac{1}{2}°$ occur. The larger crystals sometimes have sharpened ends. The mineral was at first taken for hornblende, but is no doubt aegyrite.

The other mineral forming radiating bundles is probably plagioclase, clearer parts showing twin lamellae, whose angle of extinction, however, could not be sharply determined owing to the small size of the lamellae. Many of these plagioclase strips are reddish-brown and almost opaque, with particles of brown iron ore.

The only other primary mineral observed, except a few needles of apatite, is the isotropic base in which the crystals

just referred to are embedded. It is clear and transparent, with some dusty spots, however, and has not the look of ordinary volcanic glass. With high powers a delicate, but distinct, system of cubic cleavage lines can be seen, proving that the mineral is isometric and therefore probably analcite, though no crystal forms were observed.

An attempt was made to isolate the glassy mineral with a heavy solution, analcite being lighter than any other rock forming mineral belonging to eruptives, and it was found that 17 per cent. of the powder floated when gypsum was used as an index (spec. grav. 2.32); but when examined with the microscope the powder was found to contain doubly refracting portions embedded in the isotropic ones, and some isotropic portions were noticed associated with the heavier minerals. Some of the rock was then treated with strong hydrochloric acid, when partial gelatinization took place, and it seemed wise to reduce the whole to dryness to render the silica insoluble. It was found that 27.76 per cent. of the whole weight went into solution, omitting, of course, the silica of the mineral which gelatinized when treated with acid. A second portion treated in the same way as a check gave 30.35 per cent. of soluble matter. Probably the first portion taken contained more of the sphaerulitic parts than the second. An analysis of the soluble part made by myself gave the following results:

Al_2O_3	10.90
Fe_2O_3	3.13
CaO	1.03
MgO	trace
Na_2O	6.60
K_2O	not. det.
H_2O (at 100°)	.69
H_2O (at red heat)	4.85
CO_2	.93
	28.13

We may assume that the only minerals in the rock which would be appreciably dissolved by HCl are analcite, limonite,

and calcite. If we subtract the lime and carbonic acid, as forming calcite, and the ferric oxide with a proportionate amount of water (.45 per cent.), as forming limonite, we have left the following:

Al_2O_3 - - - - -	10.90	.107 = 1
Na_2O - - - - -	6.60	.106 = 1
H_2O (at red heat) - -	4.40	.244 = 2.28

Reducing to molecular ratios, alumina and soda are equal, and water stands at 2¼, proportions that correspond to those of analcite, except for a little too much water.

If the alumina in analcite equals 10.90 per cent. the corresponding amount of silica, four molecules, is 25.49 per cent., and the whole percentage of analcite in the rock is almost exactly 47, nearly one half. In the second part treated with acid, when 30.35 per cent. proved soluble, the amount of analcite must be more than half the whole weight of rock taken If we subtract the percentages of substances found in the first portion of rock dissolved in hydrochloric acid from the results of the complete analysis, and also the proper amount of silica to form analcite with the alumina, soda, and combined water, we shall have left the materials forming the insoluble ingredients of the rock.

The complete analysis given below was made by Mr. H. W. Charlton, his results being put in column I. In column II an analysis by Dr. Mann of cancrinite-aegyrite-syenite from Siksjö-Berg in Dalarne[1] is given because of its rather close resemblance to No. 1; and in column III an analysis of analcite-basalt from the Basin, Colorado, by W. F. Hillebrand.[2]

A little more than 46 per cent. of the rock remains unaccounted for by the partial analysis; and if we suppose the whole of the potash to belong to orthoclase and the unused portion of iron oxide (1.40 per cent.) to belong to aegyrite, we have left

[1] Neues Jahrbuch für Mineralogie, 1884, II, p. 193; as quoted by ZIRKEL, Lehrbuch der Petrographie, Band II, p. 410.

[2] WHITMAN CROSS, an Analcite-Basalt from Colorado, JOUR. GEOL., Vol. V, No. 7, 1897, p. 689.

	I	II	III
SiO_2	52.73	51.04	45.59
TiO_2		.29	1.32
ZrO_2			.03
Al_2O_3	20.05	20.47	12.98
Fe_2O_3	3.43	1.89	4.97
FeO	.99	2.19	4.70
MnO			.14
CaO	3.35	2.62	11.09
SrO			.12
BaO	.11		.13
MgO	.17	.97	8.36
K_2O	4.77	3.52	1.04
Na_2O	7.94	11.62	4.53
H_2O (at 100°)	.69	5.85	.51
H_2O (at red heat)	4.85		3.40
P_2O_5	trace	.27	.91
Cl			.05
CO_2	.93	.62	
	100.01	101.35	99.87
Spec. Grav.	2.466	2.46	

silica, alumina, lime, and soda nearly in the proportions required for labradorite (Ab. 2 : An. 3), though the lime and soda are about one third in excess of the amount required, the excess being less than 1 per cent., however.

Summing up the results arrived at, the minerals forming the rock have the following percentages :

Analcite	47.00
Orthoclase	28.24
Labradorite	13.00
Aegyrite	4.04
Limonite	3.59
Calcite	1.96
	97.83

In this computation moisture removed at 100°, unimportant percentages of magnesium and barium oxides, etc., amounting in all to 1.47 per cent., have been neglected.

The composition of the rock as shown by the analysis differs widely from that of analcite-basalt, as may be seen from a com-

parison of columns I and III, the latter being more basic, containing less alumina and alkalies, and far more lime and magnesia. It corresponds fairly well, however, to the composition of nepheline syenite, the only important difference being in the amount of water. The syenite from Dalarne, whose analysis is given in column II of the table, having its nepheline weathered to a hydrous mineral, resembles this rock closely in composition, the only important difference being the larger percentage of soda. In their unusually low specific gravity, 2.46, also the two rocks are alike.

One naturally expects to find the dike containing the rock above described in connection with some boss of nepheline syenite; but the slight examination hitherto made of the region by Dr. Bell and myself has not disclosed any area of that rock.

If the analcite rock of Heron Bay had a granular texture, it would appropriately be named analcite-syenite, after the analogy of nepheline-syenite; but its peculiar structure of spherical groups of orthoclase embedded in a ground of analcite containing radiating bundles of plagioclase laths and aegyrite needles sets it quite apart from the syenites. It will probably be wise to give it a separate name, and Heronite, from the name of the locality where it occurs, is suggested as suitable.

Heronite may be defined as a dike rock consisting essentially of analcite, orthoclase, plagioclase, and aegyrite, the analcite having the character of a base in which the other minerals form radiating groups of crystals. The analcite clearly represents the magma left after the crystallization of the embedded minerals; and it is evident that it can be formed only from a magma highly charged with water, and therefore under pressure. It is equally evident that Heronite, like other analcite rocks, cannot be an effusive, since under those circumstances the water would escape;[1] and that its nearest relatives among effusive as well as plutonic rocks are to be found in the group containing nepheline.

A. P. COLEMAN.

[1] Cf. PIRSSON, Analcite Group of Igneous Rocks, JOUR. GEOL., Vol. IV, No. 6, pp. 686–688.